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Book Review: Ian M. Turner. 2001. **The Ecology of Trees in the Tropical Rain Forest.** 298 pages. Cambridge University Press, Cambridge, United Kingdom. ISBN 0-521-80183-4. Price: S$75.90

This book by Ian Turner represents an outstanding introduction to the biology of tropical rainforest trees, and represents an ideal background text for researchers and students wanting to dig more deeply into the subject. It would be ideal for research students in plant ecology prior to conducting more field work, it would be essential background for students in animal ecology to understand the system in which animals are living, and it would represent the logical next book for those people who enjoyed reading the more general books by T.C. Whitmore (*An Introduction to Tropical Rain Forests*) and P.W. Richards (*The Tropical Rain Forest*). This new book has its focus on the individual tree, rather than the forest itself as in these previous two books. As such, the book presents material, which connects with these books, but does not duplicate their focus. The book would also make an excellent discussion book for a graduate level course on tropical trees.

The book is organized according to the life cycle of the tree, beginning with the growing tree, with good coverage of the trunk, the roots and leaves. The next chapter covers tree performance, considering growth and mortality. Reproductive biology comes next, considering breeding systems, pollination and fruit dispersal. Logically following is a chapter on seed size, and seedling form and ecology. The final chapter considers the characteristics and usefulness of systems of tree classifications, including pioneer versus climax trees, level of shade tolerance, and size and canopy position at the time of flowering.

Within each of these chapters, the material is organized by more specific topics. The overall effect is very satisfying. Individual topics are introduced, the major issues are presented, controversies are presented, the most relevant research is referenced and summarized, and then areas requiring further research are outlined. In effect, much of the presentation is organized as mini-reviews of the most important topics in tropical tree ecology. How does sap ascend tropical trees in a high humidity environment? Why do trees have buttresses? Do mineral nutrients, light or other factors limit tree growth? Why are the leaves of so many tropical trees similar in shape? Do trees have clumped or scattered distributions, and are patterns caused by density-dependant effects? Can seedlings and adult trees be classified into shade-tolerant and shade-intolerant species, or are they better classified as pioneer and climax species?

The book will be useful to researchers with both general and specific

interests. For example, I have wondered whether tropical legume trees in the forest fix nitrogen. I have periodically asked people about this, but I have not gotten a specific or authoritative answer. This specific topic is dealt with here with a clear and efficient one-and-half page summary of the latest ideas and literature. Information is presented that 23% of caesalpinioid legumes, which are trees in the forest, have been recorded to form root nodules with nitrogen-fixing bacteria; much less than the 97% of papilionoid legumes which form nodules. It may be that low phosphorus availability, soil acidity, and abundant aluminium inhibit nitrogen fixation in these systems. However, work with stable isotopes does indicate nitrogen fixation in many tropical tree legumes, casuarina trees and cycads. The section also includes a brief mention of the presumed evolutionary origins of this relationship. I mention this example in detail because it was one that I was particularly interested in, and here found such a concise and informative discussion.

I think that for many students and researchers the extended discussion of the evidence for shade intolerance and shade tolerance, pioneer and climax species, and tree size would well be worth the price of the book. There is abundant research on this topic, but Turner summarizes the key evidence and points out the correlations among these various ways of looking at trees, and the preponderance of continuity of species along axes of characteristics rather than species fitting into neat categories.

There is one way in which I think the book fails to live up to its promise. On the final page, in his final section, Where does this leave us? Turner states, "One of my objectives when I set out to write this book was to see if there was a new synthesis of the comparative ecology of tropical trees awaiting discovery amidst the voluminous literature on tropical rain forests. I have failed to find a new synthesis." I think Turner is wrong here on two counts. First, he has provided numerous syntheses of significant controversies in tropical ecology, which will guide research projects for years to come. People will read this book and obtain ideas about what are likely to be productive areas of research.

But more importantly, I think that Turner has failed to outline the ways in which tropical trees will respond to the ever-increasing threats to forests posed by human activity. These problems represent the next major round of research in this field, but Turner does not discuss them. For example, what will be the impact on tree biology of global climate change? If the climate becomes warmer or drier, or the atmosphere has a higher carbon dioxide concentration, how will this affect individual trees and the forest in general? Will this tip the scale to trees with a certain type of physiology or growth form or shade intolerance? If forests are increasingly

fragmented by human activities, including logging, agriculture, roads, ranching, and fire, how will this affect trees? And lastly, how will tropical trees respond to human-caused changes in their reproduction? Introduced Africanized honeybees are taking over pollination systems throughout Latin America, seed dispersing animals are being hunted out of the forest throughout the tropics to the point that many trees are no longer having their seeds dispersed, and cattle and fire in the forest understorey are eliminating the forest understorey in many places. These topics considered together represent the new direction of research in the ecology of tropical trees. Even though Turner did not outline this next major area of research, his book represents a tremendous advance in the field and is to be greatly appreciated.

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